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AUTHOR Stemmer, Paul M., Jr.; And Others
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ABSTRACT

Both challenges and successes resulted from the implementation of computer-based or computer-assisted instruction (CAI) at Mercy College of Detroit through a program funded with a Comprehensive Assistance to Undergraduate Science Education (CAUSE) grant. Four influences were found most significant in faculty-related challenges: computer phobia, tradition bias, amount of faculty computer contact time, and acquisition and dissemination of courseware. Operational and administrative challenges included establishing goals and objectives, and use of instructional design to help promote and develop computer-based education materials. External sources of challenge for courseware were quality, match to curriculum, and design faults, and, for hardware, microcomputer selection and placement. The CAUSE project appeared most successful in the areas of faculty development and computer-managed instruction. Implications of the study for manufacturers and educational institutions that might be implementing CAI concern (1) need for an industrial hardware standard or conversion programs; (2) vendor provision of demonstration discs or actual programs for review as well as courseware evaluation results; (3) need for courseware that actually helps in the teaching process; (4) release time and inservice training for instructors as well as computer contact time; and (5) use of instructional designers to develop program specifications. (LMM)

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Implementation of Computer Based Education by a Small College

by

Paul M. Stemmer, Jr., Instructional Designer

William T. Nolan, Associate Professor of Chemistry

Linda M. Culler, Instructor of Mathematics

Mercy College of Detroit
Computing Resource Center
8200 W. Outer Dr.
Detroit, Michigan 48219

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In an effort to keep up with the state of the art in education, Mercy College of Detroit undertook a project to implement a system of Computer Based Education (CBE) programs. Part of these programs were developed thanks to the aid of a National Science Foundation CAUSE (Comprehensive Assistance to Undergraduate Science Education) grant. The purpose of this article is to outline the challenges that faced us and our successes in the implemention of computer based education. Although Mercy is a relatively small college (1700 students), much of our experience would be applicable to a variety of educational settings.

Our Challenges

There were many factors that challenged our goal of the implemention of CBE into the classroom. We have categorized these challenges into faculty, operational/administrative, organizational and external sources. External sources are those outside the control of the college, such as hardware compatibility and the quality of commercial courseware.

Faculty

The faculty at Mercy College are really not much different than most faculty at other small colleges when it comes to CBE. Most of our faculty were curious about this new technology; some were quite enthusiastic, but others were totally skeptical.

The following four influences were among the most significant:

1. Computer phobia
2. Tradition bias
3. Amount of faculty computer contact time
4. Acquisition and dissemination of courseware

Computer Phobia. We are not talking about just ordinary fear of the computer, but fear that the instructor may "lose control" of some aspect of teaching his/her course. Fear that the students may know more about using the equipment than the instructor would also fall into this category.

In general, the workshops that the CAUSE grant provided were effective in reducing instructor phobia. But for many individuals, the 3 to 5 hours of direct hands on experience during the workshops were not enough for them to feel "in control."

Tradition bias. Instructors have a tendency to teach the way they were taught. Often in college settings the instructors are well trained in their subject areas but have received little or no training in teaching skills. There is also a reluctance to adopt any new teaching method that does not "fit" with the way they have taught the course in the past, especially if the new teaching methods are untested!

Some CBE materials presented such totally new approaches that they were summarily rejected. CBE materials that reflected computerized traditional approaches were more readily accepted than

non-traditional ones. However, some of these materials were electronic flash cards or simply textbook page turners that added nothing to the traditional teaching approach.

But faculty members are not necessarily to be faulted. They have a large demand on their time. It is easier to stay with traditional methods when an instructor does not have time to devote to adopting new approaches. Computer Based Education is so new that it has not yet found its niche in the classroom. Many times the use of a computer in the classroom required the instructor to restructure their course in fundementally new ways. As one might expect, until enough research is compiled to tell us how and when CBE will enhance learning, faculty will probably prefer "time-tested" approaches that they know are successful. This does not excuse instructors from trying unique and innovative practices. A proper balance between new methods and old methods is usually desirable. It is far easier to say, "I don't think this will work," than to say, "Let's give it a try." A willingness to accept risk is needed. Overall, it appears that most instructors tend to be biased towards traditional approaches and are biased against CBE implementation. Part of this bias is simply that more work will be required and the manner in which the course is taught will change.

Computer contact time. There was a direct relationship between the amount of contact time with the computer and the amount of CBE implementation.

It is obvious that administration must be willing to grant a

significant amount of released time to the faculty in order to implement CBE. Faculty members who were granted released time by reducing their teaching loads were far more likely to implement and develop CBE than those who had full loads.

At small colleges such as ours, an instructor's time is taken up by many tasks such as committee work, new course planning, etc. Often the amount of work in a given semester is underestimated. For example, science laboratory courses take time to set up, conduct and to assess results. In other words, when considering released time, one must look at the full workload of the instructor, not just at the number of hours in the classroom. As we mentioned earlier, workload also contributes to the lack of time an instructor has available to develop new approaches.

Acquisition and dissemination of Software. Our general policy was not to buy any software until we had seen a demonstration program. We then reserved the right to return the package if the overall quality was inferior. There were a number of companies who sold or loaned us demonstration diskettes. However, some companies refused to do so. In fact, one company told us that they would rather not sell to us than to send us refundable courseware or offer a demonstration copy. We understand the seriousness of the piracy problem. However, it seems that some companies have worked out better demonstration policies.

We began getting courseware to review at a fast pace and we

asked our faculty to serve as content experts. It was often difficult to get their cooperation (released time?) due to their busy schedules. Due to the high incidence of poor quality courseware, the faculty then became reluctant to review new courseware, expecting to review yet another inferior product.

Operational/Administrative Challenges

It is important for a project to establish goals and objectives. Although a difficult task, with CBE it is absolutely essential. We found it difficult to decide how CBE should relate to the goals of the individual classes and what role the CBE material should play in the classroom. Should student work on courseware be graded? Should it be required? How much of the course should be CBE based? Strong, supportive, leadership is needed to help the design team define some aspects of these problems.

Instructional designers were used to help promote and develop CBE materials. The time needed for development of original CBE material was underestimated. Projects took 3 to 5 times longer to develop than we expected. For example, a one hour long instructional sequence (which included computer graphics, and animation) took 450 hours to develop. Part of this problem can be attributed to the fact that instructional designers were used as coders and programmers and had other duties to attend to.

Once faculty began using the computers, the designers also spent a large amount of time giving technical advice and trouble

shooting mechanical failures. These extra activities sometimes interrupted lesson design and production, causing some delays.

External Sources

Courseware. Since we did not intend to "re-invent the wheel," our first order of business was to purchase quality courseware which would entice our students and faculty to use the computer more frequently. In addition, the courseware would serve as a model for in-house development of courseware.

In order to determine quality, we searched for a standard means to evaluate courseware. After finding that there was no standard, we developed our own.

Using our evaluation method which emphasized clarity, accuracy of content, correct grammar and motivation, we found that 82 programs out of 135 reviewed or about 61 percent were judged unacceptable. This was a discouraging factor since we ended up spending more time looking for courseware than we had anticipated.

Any program that used improper English or grammar was rejected. It was surprising to us that a number of commercial products were released with blatant grammatical or spelling errors. This seems especially strange in view of the availability of spelling and grammar-checking software. With the recognition that large numbers of students are entering college with poor grammatical skills, we feel that it would be especially bad to use such materials, regardless of their other merits.

Many times the overall quality was acceptable but there were occasional content mistakes or inconsistencies. For example, lowercase letters are extremely important in chemical symbols. The symbol "FE" would most likely be correctly interpreted by the student as the symbol for the element iron (Fe). But how would the student interpret the symbol "CO"? "CO" is the formula for carbon monoxide; "Co" is the symbol for cobalt. Many chemical programs used all uppercase letters causing considerable confusion.

Some software met our quality standards but did not match our curriculum. We would have purchased some of these materials if we could have modified the programs to delete parts or change the order of presentation. Unfortunately, some programs had copy protection that would not allow us to modify them to suit our needs. They had to be returned. There were many such copy protected, "take-it-or-leave-it" packages.

Not all courseware was in the acceptable-with-changes category. Many programs were unacceptable for a variety of reasons. Our policy was to compare the courseware with existing media, such as textbooks, programmed texts, videotapes, slides, or filmstrips. We asked ourselves the question: Did we already have any type of media in our resource center that performed a given task better than the courseware being evaluated? Many times that answer was yes.

We also found many design faults with courseware. Many of the problems stemmed from not allowing student control over the

learning rate. For example, we found a number of programs that would present an answer or learning frame, wait a period of seconds, and go on. This created a high level of frustration. Some students read or comprehend slowly. A program that erases pages of text at a fixed rate puts unnecessary pressure on weaker students. The fixed rate is also a problem if a student is distracted and misses a learning frame.

Other programs would go into lengthy remedial modes because the student (who knew the correct answer) miss-keyed and was not given the chance to correct before the computer accepted the response. The worst possible case occurred when the program accepted the wrong answer and would not accept the correct answer. Some programs would look for only one possible answer when several possible answers were commonly acceptable.

We found a considerable amount of unacceptable courseware. It appeared as though the authors were either unskilled programmers or had never seen a classroom. Incidentally, price provided no hint of the overall quality. The more expensive poor quality programs were the most annoying.

Hardware. We began the CAUSE grant using a Digital Equipment Corporation PDP 11/70 mini-computer, but a number of problems were encountered early in the grant period:

1. Administrative uses for the PDP 11/70 continued to grow.
2. A central location of the terminals proved to be too inconvenient for faculty and students.

3. Competition for terminal time during peak periods of use among student users increased.
4. The PDP 11/70 lacked sound and hi-resolution color graphics.*
5. Down time at important deadlines was a reoccuring problem.

These problems along with the growing popularity of microcomputers, led us to decide on microcomputers as the major hardware source for CBE. We will continue to use the PDP 11/70 for those programs already developed on it. We will also continue to use the PDP 11/70 for CBE when central data based records are needed, or to take advantage of our GIGI terminals.

Our first problem was to choose the type of microcomputer to purchase. The problem was that many different microcomputers were not compatible with one another. Software which runs on one machine was not available on another. We knew that once chosen, the hardware would limit our courseware selection to that particular type of system. We chose the Apple II+ and subsequently the II/e since they offered sound, hi-resolution graphics and a large volume of compatible software. The Apples were also the most flexible (i.e. they allowed for expansion).

We located all our Apples in the computer center for security reasons. However, faculty and students found the placement to be too inconvenient and unattractive. We are not sure how the environment had an affect on faculty and students, but when we moved the Apples to the Learning Resource Center, where the

*The problem of hi-resolution was greatly improved with a grant from Digital Equipment Corporation of 5 GIGI (General Imaging Generator and Interpreter) terminals.

college's other learning media (audio-visual equipment, etc.), are kept, we noticed an increase in use. We concluded that the environment in which the computers are placed can have a considerable influence on the amount of use.

Our Accomplishments

There were two major areas in which we feel the CAUSE project has had the most influence: faculty development and computer managed instruction.

Faculty development. Well over half of our full-time faculty (58/90) attended the workshops presented. Workshops were given on broad topics such as "What is CBE"? to narrower topics such as "Computers in Medicine and Allied Health." These workshops succeeded in informing faculty of current trends in CBE. This clearly was not enough to increase significantly the use of CBE in the classroom. Computer contact time was a much more important factor.

Another factor that impacted favorably on the implementation of CBE at our college was the significant and growing number of faculty who had purchased microcomputers for home use. The enthusiasm displayed by these home computer owners was contagious. These faculty members also had a tendency to implement CBE more often.

Through the efforts of one faculty member*, a computer user

* Dr. Robert Kimball

support group was formed in order to share information on new microcomputer hardware and software developments. This group, and the commitment of administration to purchase Apple microcomputers, probably influenced the faculty in their decisions to purchase microcomputers for their personal use. Faculty decided that they would take advantage of being able to create programs that would run on the college's computers. In addition, they could take software home to preview and could edit memos, letters and articles at home using the same word processing software as at work.

Computer Managed Instruction. (CMI) We defined CMI as use of the computer to test and manage information about test results and test items. Our CMI programs feature self-tests which the students take to monitor their progress. These programs were well received by students. The self-tests can be taken at any time. The Mathematics Department uses a program that generates multiple hard copy tests that students take home. The Biology and Chemistry Departments use programs that are taken and scored on the PDP 11/70. The programs are used by the students to outline their strengths and weaknesses. The students like to use the programs to study for in-class examinations. The programs are popular with faculty because they receive detailed reports on the progress of their students and because the programs help create more class time for useful discussions of concepts.

Summary and Recommendations

We were pleased with our successes, but we remain challenged

by some of our difficulties. We will be moving our Apples to decentralized locations to allow faculty and students more access and more contact time. We offer the following recommendations to manufacturers and educational institutions that might be implementing CBE.

1. Hardware manufacturers need to realize that the proliferation of incompatible systems causes confusion and dismay. Faculty and students have purchased different systems for home use. An industry standard or conversion programs are badly needed.

2. Courseware vendors should supply demonstration disks or actual programs for review. They must test the effectiveness of their product and publish the results.

3. Excellent courseware that actually helps in the teaching process is hard to find. Courseware users must learn to discriminate between programs that just add bells, whistles and flashes to "textbook" presentations and quality, educational courseware.

4. Educational institutions can encourage the implementation of CBE in the classroom by granting instructors released time (lighter work load) and by promoting inservice workshops (although computer contact time is far more important.)

5. Developing in-house quality software that "adds" something extra to the educational experience is <u>very</u> labor-intensive. Instructional designers are a good addition to a design team. Their time should be devoted to developing program specifications. Technical programming and coding should be delegated to student assistants.